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JC665 U.S. PTO

**UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)***(Only for new nonprovisional applications under 37 CFR 1.53(b))*Docket No.
DBS-109Total Pages in this Submission
103**TO THE ASSISTANT COMMISSIONER FOR PATENTS**Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

Borehole Opener

and invented by:

Leif Akesson and Antonio Carosielli

JC675 U.S. PTO
09/521408
03/08/00If a **CONTINUATION APPLICATION**, check appropriate box and supply the requisite information:☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____

Which is a:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____

Which is a:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____

Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 12 pages and including the following:
 - a. ☒ Descriptive Title of the Invention
 - b. ☐ Cross References to Related Applications *(if applicable)*
 - c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*
 - d. ☐ Reference to Microfiche Appendix *(if applicable)*
 - e. ☒ Background of the Invention
 - f. ☒ Brief Summary of the Invention
 - g. ☒ Brief Description of the Drawings *(if drawings filed)*
 - h. ☒ Detailed Description
 - i. ☒ Claim(s) as Classified Below
 - j. ☒ Abstract of the Disclosure

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

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DBS-109

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103

Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
- a. ☒ Formal Number of Sheets 3
- b. ☐ Informal Number of Sheets
4. ☐ Oath or Declaration
- a. ☐ Newly executed *(original or copy)* ☐ Unexecuted
- b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
- c. ☐ With Power of Attorney ☐ Without Power of Attorney
- d. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application,
see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under
Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby
incorporated by reference therein.
6. ☐ Computer Program in Microfiche *(Appendix)*
7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
- a. ☐ Paper Copy
- b. ☐ Computer Readable Copy *(identical to computer copy)*
- c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☐ Assignment Papers *(cover sheet & document(s))*
9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*
10. ☐ English Translation Document *(if applicable)*
11. ☒ Information Disclosure Statement/PTO-1449 ☒ Copies of IDS Citations
12. ☒ Preliminary Amendment
13. ☒ Acknowledgment postcard
14. ☒ Certificate of Mailing
- ☐ First Class ☒ Express Mail *(Specify Label No.):* EL010850735US

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Accompanying Application Parts (Continued)

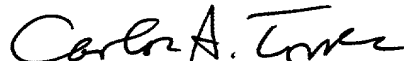
15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. ☒ Additional Enclosures *(please identify below):*

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	12	- 20 =	0	x \$18.00	\$0.00
Indep. Claims	1	- 3 =	0	x \$78.00	\$0.00
Multiple Dependent Claims (check if applicable) <input checked="" type="checkbox"/>					\$260.00
BASIC FEE					\$690.00
OTHER FEE (specify purpose)					\$0.00
TOTAL FILING FEE					\$950.00

- ☒ A check in the amount of **\$950.00** to cover the filing fee is enclosed.
- ☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **02-4345** as described below. A duplicate copy of this sheet is enclosed.
- ☐ Charge the amount of _____ as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).


Signature

Carlos A. Torres, Reg. No. 24,810
Browning Bushman
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Fax: (713) 266-5593

Dated: March 8, 2000

cc:

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	§	Attorney Docket No.: DBS-109
	§	
Leif Akesson and Antonio Carosielli	§	
	§	
Serial No.: To Be Assigned	§	
	§	
Filing Date: Herewith	§	
	§	
For: <i>Borehole Opener</i>	§	

PRELIMINARY AMENDMENT

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Kindly amend the above-identified application as follows:

In the Specification

On page 1, below the title, insert the following heading and subheading:

--BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION--

On page 1, between lines 14 and 15, insert the following subheading:

--BACKGROUND OF THE PRIOR ART--

On page 2, between lines 26 and 27, insert the following heading:

--SUMMARY OF THE INVENTION--

On page 2, in line 35, delete "length" and insert therefor --lengthwise--.

On page 4, before line 1, insert the following heading:

--BRIEF DESCRIPTION OF THE DRAWINGS--

On page 4, between lines 13 and 14, insert the following heading:

--DESCRIPTION OF THE PREFERRED EMBODIMENTS--

On page 5, in line 36, delete "the or".

On page 5, in line 36, delete "comprises" and insert therefor --engages--.

On page 6, in line 23, delete "the or each point" and insert therefor --one or more points--.

On page 12, delete the heading "Borehole opener".

On page 12, in line 25, delete "Figure 1.".

In the Claims

Please amend Claims 1-10 as follows:

1. **(Amended)** A [borehole] hole opener, particularly for enlarging [this hole] the borehole underneath a casing [in the field of oil prospecting], comprising:
 - a body (2) of longitudinal axis (3),
 - a duct (4) for drilling fluid, formed longitudinally in the body (2), and
 - at least two hole-opening arms (5), each arm having
 - [which have] an active part (7) equipped with cutting means (8),
 - [which are] distributed symmetrically in the body (2) about the longitudinal axis (3), and
 - [which are] said hole-opening arms arranged [therein] in such body in a way that [they] said arms can be moved between a position of rest (9) in the body (2) and an active position (10) partially out of the body (2), and

wherein, in order to move [it] said arms from the position of rest (9) into the active position (10), each arm (5) has a face (12), internal to the body (2), designed to be subjected directly[, in the same way as an active face of a piston,] to the pressure of the drilling fluid flowing through the body (2).

2. **(Amended)** The hole opener as claimed in claim 1, wherein [the arm (5)] at least one of said arms (5) is mounted in such a way that [it] said at least one arm can slide parallel to itself in the body (2), so as to move from the position of rest (9) into the active position (10) [and vice versa].

3. **(Amended)** A hole opener as claimed in either of claims 1 [and] or 2, wherein, to move the arms from the active position (10) into the position of rest (9), the hole opener (1) comprises [means for] an elastically effective return for returning the arms (5) to the position of rest.

4. **(Amended)** A hole opener as claimed in [any of claims 1 through 3] claim 1, wherein each arm (5) is temporarily kept in the position of rest (9) [prior to a hole-opening operation,] by at least one pin (19) designed to break when the pressure of the drilling fluid flowing through the duct (4) exceeds a predetermined value [higher than a maximum usual boring value].

5. **(Amended)** A hole opener as claimed in [any of claims 1 through 4] claim 4, wherein [the arm] at least one of said arms (5) is mounted in the body (2) by means of an intermediate support (15) which acts as a housing for [the] said at least one arm (5) in the body (2) and which is fixed to [the latter] said at least one arm.

6. **(Amended)** A hole opener as claimed in claim 5, wherein the aforementioned pin (19) fixes [the] said at least one arm to [the] said intermediate support (15).

7. **(Amended)** A hole opener as claimed in [either of claims 5 and 6] claim 6, wherein the intermediate support (15), the at least one arm (5), the aforementioned [elastic return means] elastically effective return (13) and the pin (19) constitute an assembly (21) designed to be assembled in advance outside the body (2) and then installed [therein] in the body.

8. **(Amended)** A hole opener as claimed in [any of claims 4 through 7] claims 4 or 5, wherein the pin (19) comprises a region (19A) of calibrated weakness[, at the point or at each point of transition (20) where the pin (19) passes, as the case may be, either from the body (2) or from the intermediate support (15) into the arm (5)].

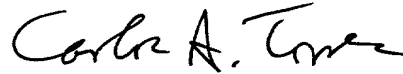
9. **(Amended)** A hole opener as claimed in [any of claims 1 through 8] claim 1, wherein

- on [its] an outer face, between two successive arms (5), the body (2) has a longitudinal passage (22) for returning drilling fluid, and
- a boss (23) arranged in this passage (22) so as to deflect the drilling fluid onto that part of the wall of the [hole] borehole on which the arms (5) are acting.

10. **(Amended)** A hole opener as claimed in [any of claims 1 through 9] claim 4, wherein the travel of [an] at least one arm (5) between the position of rest (9) and the active position (10) is limited by stops, and also by the pin (19) [where appropriate,] so that in the position of rest (9), [the] said at least one arm (5) is fully retracted into the body (2) and so that in the active position (10), [the] said at least one arm (5) sweeps through an area, the largest diameter of which area

is equal to between 1.05 and 1.3 times[, preferably 1.2 times,] the nominal diameter of a drill bit associated with the hole opener (1) for a combined drilling and hole-opening operation.

Respectfully submitted,



Carlos A. Torres
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Date: 03-08-00

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CERTIFICATE OF EXPRESS MAILING

I, Jan C. Lipscomb, hereby certify that this correspondence and all referenced enclosures are being deposited by me with the United States Postal Service as Express Mail with Receipt No. EL010850735US in an envelope addressed to Box Patent Application, Assistant Commissioner for Patents, Washington, DC 20231, on March 8, 2000.

By: Jan C. Lipscomb

SPECIFICATION

Docket No.: DBS-109/P1334

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN that we, Leif Akesson and Antonio Carosielli, citizens of Norway and Belgium, respectively, and residing at Folkvoldveien 132, 4300 Sandnes, Norway and Rue des Bleuets 124, 7160 Chapelle-Lez-Herlaimont, Belgium, respectively, have invented new and useful improvements in a

BOREHOLE OPENER

of which the following is a specification:

CERTIFICATE OF EXPRESS MAILING

I, Jan C. Lipscomb, hereby certify that this correspondence and all referenced enclosures are being deposited by me with the United States Postal Service as Express Mail with Receipt EL010850735US in an envelope addressed to Box Patent Application, Assistant Commissioner for Patents, Washington, DC 20231, on March 8, 2000.

By: Jan C. Lipscomb

[illegible][illegible][illegible][illegible]

removal of particles of formation which would build up in the hole and which would have an adverse influence on the equivalent density.

To achieve this it is known practice possibly
5 to make use of a conventional hole opener, with moving arms, which can enlarge the diameter of the hole already bored to up to twice its original size. Hole openers known to date comprise mechanisms, of the hinge and pivot-pin type, which are rather delicate to be
10 used at a high rate of advance and are too long to be placed between the drill bit and, in particular, an angled coupling well known to those skilled in the art and employed for directional drilling.

Drill bits with two offset longitudinal axes
15 (bi-center bits) and pilot tools (pilot bits) associated with boring tools and comprising a hole-opening fin fixedly projecting from the rest of the bit are already known. These devices are able to open out the hole at the same time as boring it.
20 However, because of their asymmetric structure, these devices have an imbalanced behavior and because of this produce vibrational forces which are detrimental to the mechanisms to which they are coupled and to the condition of the bored hole. What is more, because of
25 this, these devices frequently cause unacceptable deviations in the bored holes.

The object of the present invention is to overcome the problems set out hereinabove and to propose a hole opener with moving arms which is compact
30 and robust and the mechanism of which involves a very small number of moving parts, these advantageously having to be easy to remove and replace in the event of an incident occurring during operation. What is more, the hole opener of the invention is to have a small
35 bulk in the length direction, so that it can readily be installed very near a drill bit, in a drill string, between the drill bit and the aforementioned angled coupling.

Underlying the invention, prior research was carried out into the amount of opening needed to solve the problem, explained hereinabove, of removing the sludge. Surprisingly, it was found that opening the
5 hole out to a diameter approximately 10 to 20% greater, for example, than that of the casing or the nominal diameter of the associated drill bit, was sufficient to achieve this.

The problem of simplifying the mechanism was
10 solved, according to the invention, by choosing that, in order to move it from the position of rest into the active position, each hole-opening arm has a face, internal to the body, designed to be subjected directly, in the same way as an active face of a
15 piston, to the pressure of the drilling fluid flowing through the body.

According to one embodiment of the invention, each arm is kept in the position of rest in the body, prior to a hole-opening operation, by at least one pin
20 designed to break when the pressure of the drilling fluid flowing through the body exceeds a predetermined value higher than a maximum usual boring value.

Operations of troubleshooting, removing and replacing any problematical parts are simplified by
25 choosing to mount the arm in the body by means of an intermediate support which acts as a housing for the arm in the body and which is fixed to the latter. As a preference, the intermediate support, the arm, elastic means for returning the arm into the body and the pin
30 constitute an assembly designed to be assembled in advance outside the body and then installed therein.

Other details and particular features of the invention will become apparent from the appended claims and from the description of the hole opener of the
35 invention, which description is given hereinbelow by way of nonlimiting example with reference to the appended drawings.

Figure 1 shows, in axial section, a hole opener of the invention, an arm visible in the figure being in the position of rest.

Figure 2 shows a partial axial section in which
5 the visible arm is in the active position.

Figures 3 and 4 each show a cross section in which three hole-opening arms are depicted in the position of rest, and in the active position, respectively.

10 Figure 5 shows, to a larger scale and in longitudinal section, an assembly comprising an arm and an intermediate support so that arms can be mounted and exchanged quickly.

In the various figures, the same references
15 denote similar or analogous elements.

The hole opener 1 of the invention, as depicted by way of example in Figures 1 to 4, comprises a body 2 of longitudinal axis 3, a duct 4 for drilling fluid, formed longitudinally in the body 2, and at least two
20 hole-opening arms 5 which are distributed symmetrically in the body 2 about the longitudinal axis 3 to make sure that the operation of the hole opener 1 is approximately balanced. Figures 3 and 4 show that three arms 5 can easily be arranged in the body 2 with angles
25 of 120° between two successive arms 5.

The arms 5 each have an active part 7 equipped with cutting means 8 (Figures 3 to 5) which are known and explained hereinbelow. The arms 5 are arranged in the body 2 so that they can be moved between a position
30 of rest 9 in this body 2 and an active position 10 partially out of this same body 2.

According to the invention, each arm 5 comprises, for moving it from the position of rest 9 into the active position 10, a face 12 internal to the
35 body 2 and designed to be subjected directly, in the same way as an active face of a piston, to the pressure of the drilling fluid flowing through the body 2. Through this arrangement, it is possible to avoid having intermediate mechanical parts between the fluid

which is to actuate the arm 5 and this arm, and the problems known to those skilled in the art which may ensue.

5 The internal face 12 of the arm 5 should be understood as meaning any face/surface in contact, at any moment in the drilling and/or hole-opening operation, with the pressurized fluid flowing through the duct 4. It is obvious that some of these faces/surfaces subjected to the same pressure will
10 compensate for each other but, overall, there remains enough positive area that, for example with a positive pressure differential of the order of 2 MPa (about 300 psi) between the pressure of the fluid in the duct 4 and that of the fluid outside the body 2 in the
15 region of the arm or arms 5, a thrust force of the order of 2000 kg can be obtained, in order to deploy the arm 5 from the body 2.

As a preference, the arm 5 is mounted in such a way that it can slide parallel to itself in the body 2,
20 so as to move from the position of rest 9 into the active position 10 and vice versa. The choice of a movement of this kind is one of the more favorable types of movement, for operation in the manner of a piston. A movement of pivoting about an axis (not
25 depicted) perpendicular to the longitudinal axis 3 and to the direction of the travel of the arm 5, and arranged somewhat away from the arm 5 is, however, also possible, but would require special machining of significantly higher cost than the machining of the
30 previous embodiment in order to implement it.

In order to provide the aforementioned piston function, sealing means 11 are provided at places which are known to those skilled in the art.

To move it from the active position 10 into the
35 position of rest 9 when the pressure in the duct 4 decreases, the or each arm 5 advantageously comprises elastic return means 13, for example compression coil springs 14 as depicted in the drawings. This

not only easier to assemble, but also easier to maintain or repair in the event of damage, etc.

On its outer face, between two successive arms 5, the body 2 may have a longitudinal passage 22 for returning drilling fluid to the surface, and a boss 23 arranged in this passage 22 so as to divert and/or deflect the drilling fluid which is rising back up toward the surface onto that part of the wall of the hole on which the arms 5 are acting. The passage 22 and the boss 23 are produced in such a way as not to form too great a restriction to the passage of the returning fluid.

It must be understood that the present invention is not in any way restricted to the embodiments described hereinabove and that many modifications may be made thereto without departing from the scope of the claims given hereinbelow.

In the preferred embodiment of the hole opener 1 of the invention, the travel of an arm 5 between the position of rest 9 and the active position 10 is limited in both directions of travel by stops. In the position of rest 9, the arm 5 is usually completely retracted into the body 2 and is held therein by reciprocal stop surfaces 25 (Figure 3) or, as appropriate, by the pin 19. In the active position 10, the arm 5, retained by reciprocal stop surfaces 26 (Figures 2 and 4), sweeps through an area, the largest diameter of which is equal to between 1.05 and 1.3 times, preferably 1.2 times the nominal diameter of a drill bit associated with the hole opener 1 for a combined drilling and hole-opening operation.

The cutting means 8 on the arms 5 are arranged by the person skilled in the art in such a way as, for example, to obtain cutting efficiency similar to that of the cutting means of the associated drill bit.

The reciprocal stop surfaces 26 may be arranged on exchangeable or adjustable elements so as to allow a user of the hole opener 1 to choose the extent to which the arms 5 can deploy out of the body 2 during service.

Key to the figures

- | | | |
|----|-----|-------------------------------------------------------|
| | 1 | hole opener |
| | 2 | body |
| 5 | 3 | longitudinal axis |
| | 4 | duct |
| | 5 | hole-opening arms |
| | 7 | active part |
| | 8 | cutting means |
| 10 | 9 | position of rest |
| | 10 | active position |
| | 11 | sealing means |
| | 12 | internal face |
| | 13 | elastic return means |
| 15 | 14 | coil springs |
| | 15 | intermediate support |
| | 16 | posterior face |
| | 17 | screws |
| | 18 | sealing means |
| 20 | 19 | pin |
| | 19A | weakened region(s) |
| | 19B | part of the pin |
| | 19C | part of the pin |
| | 20 | transition point |
| 25 | 21 | assembly |
| | 22 | longitudinal passage |
| | 23 | boss |
| | 25 | reciprocal stop surfaces |
| | 26 | reciprocal stop surfaces |
| 30 | S | direction of advance of a hole-opening/boring process |

Claims

1. A borehole opener, particularly for enlarging this hole underneath a casing in the field of oil
5 prospecting, comprising:

- a body (2) of longitudinal axis (3),
- a duct (4) for drilling fluid, formed longitudinally in the body (2), and
- at least two hole-opening arms (5)
10 - which have an active part (7) equipped with cutting means (8),
- which are distributed symmetrically in the body (2) about the longitudinal axis (3), and
15 - which are arranged therein in such a way that they can be moved between a position of rest (9) in the body (2) and an active position (10) partially out of the body (2),

20 wherein, in order to move it from the position of rest (9) into the active position (10), each arm (5) has a face (12), internal to the body (2), designed to be subjected directly, in the same way as an active face of a piston, to the pressure of the drilling fluid
25 flowing through the body (2).

2. The hole opener as claimed in claim 1, wherein the arm (5) is mounted in such a way that it can slide parallel to itself in the body (2), so as to move from the position of rest (9) into the active position (10)
30 and vice versa.

3. A hole opener as claimed in either of claims 1 and 2, wherein, to move the arms from the active position (10) into the position of rest (9), the hole opener (1) comprises means for elastically returning
35 the arms (5).

4. A hole opener as claimed in any of claims 1 through 3, wherein each arm (5) is kept in the position of rest (9) prior to a hole-opening operation, by at least one pin (19) designed to break when the pressure

of the drilling fluid flowing through the duct (4) exceeds a predetermined value higher than a maximum usual boring value.

5. A hole opener as claimed in any of claims 1 through 4, wherein the arm (5) is mounted in the body (2) by means of an intermediate support (15) which acts as a housing for the arm (5) in the body (2) and which is fixed to the latter.

6. The hole opener as claimed in claim 5, wherein the aforementioned pin (19) fixes the arm to the intermediate support (15).

7. A hole opener as claimed in either of claims 5 and 6, wherein the intermediate support (15), the arm (5), the aforementioned elastic return means (13) and the pin (19) constitute an assembly (21) designed to be assembled in advance outside the body (2) and then installed therein.

8. A hole opener as claimed in any of claims 4 through 7, wherein the pin (19) comprises a region (19A) of calibrated weakness, at the point or at each point of transition (20) where the pin (19) passes, as the case may be, either from the body (2) or from the intermediate support (15) into the arm (5).

9. A hole opener as claimed in any of claims 1 through 8, wherein

- on its outer face, between two successive arms (5), the body (2) has a longitudinal passage (22) for returning drilling fluid, and
- a boss (23) arranged in this passage (22) so as to deflect the drilling fluid onto that part of the wall of the hole on which the arms (5) are acting.

10. A hole opener as claimed in any of claims 1 through 9, wherein the travel of an arm (5) between the position of rest (9) and the active position (10) is limited by stops, and also by the pin (19) where appropriate, so that in the position of rest (9), the arm (5) is fully retracted into the body (2) and so that in the active position (10), the arm (5) sweeps through an area, the largest diameter of which is equal

- 11 -

to between 1.05 and 1.3 times, preferably 1.2 times, the nominal diameter of a drill bit associated with the hole opener (1) for a combined drilling and hole-opening operation.

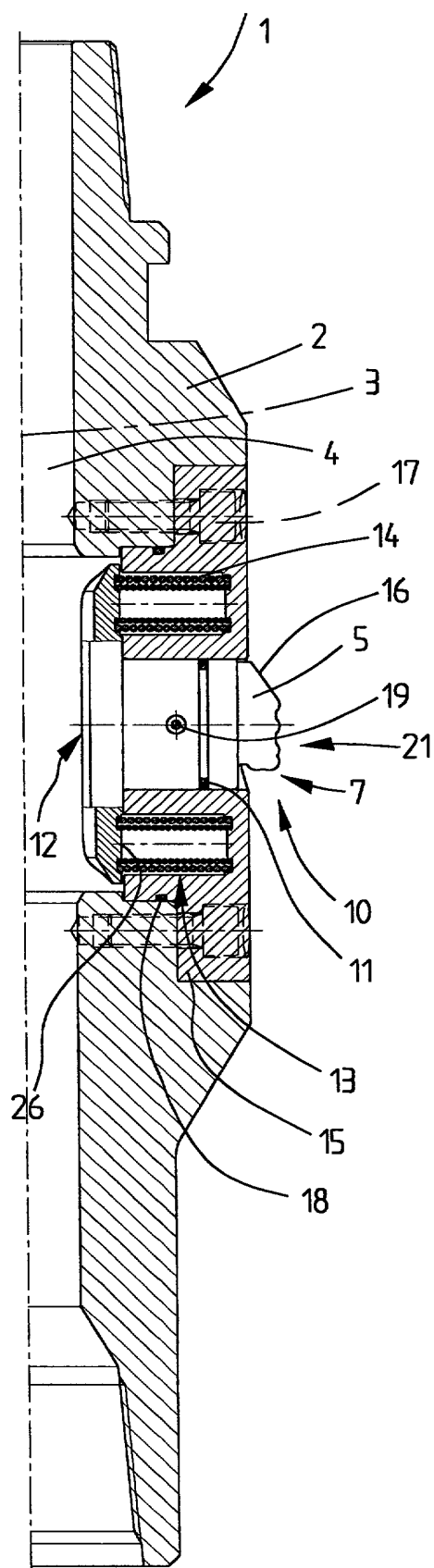
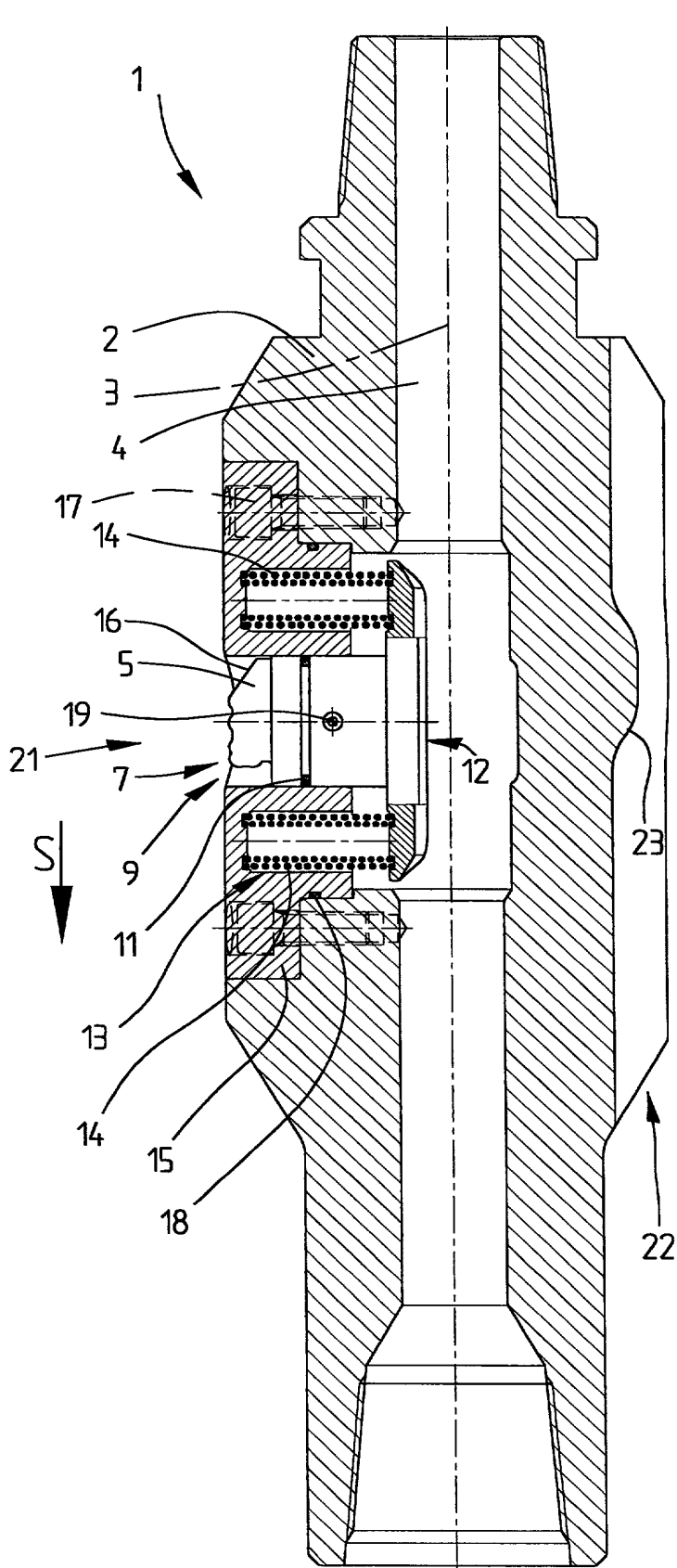
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Abstract

Borehole opener

Borehole opener, particularly for enlarging this hole underneath a casing in the field of oil prospecting, comprising a body (2) of longitudinal axis (3), a duct (4) for drilling fluid, formed longitudinally in the body (2), and at least two hole-opening arms (5) which have an active part (7) equipped with cutting means (8), which are distributed symmetrically in the body (2) about the longitudinal axis (3), and which are arranged therein in such a way that they can be moved between a position of rest (9) in the body (2) and an active position (10) partially out of the body (2); in this hole opener in order to move it from the position of rest (9) to the active position (10), each arm (5) has a face (12), internal to the body (2), designed to be subjected directly, in the same way as an active face of a piston, to the pressure of the drilling fluid flowing through the body (2).

Figure 1.



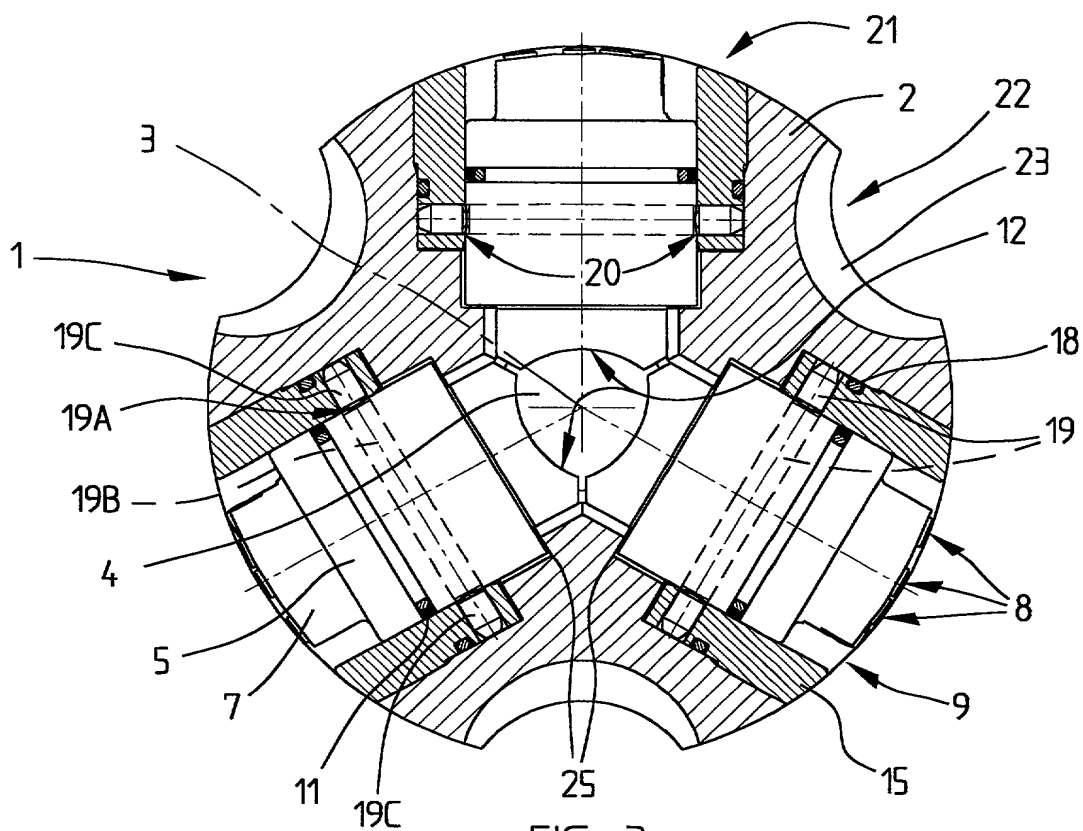


FIG. 3

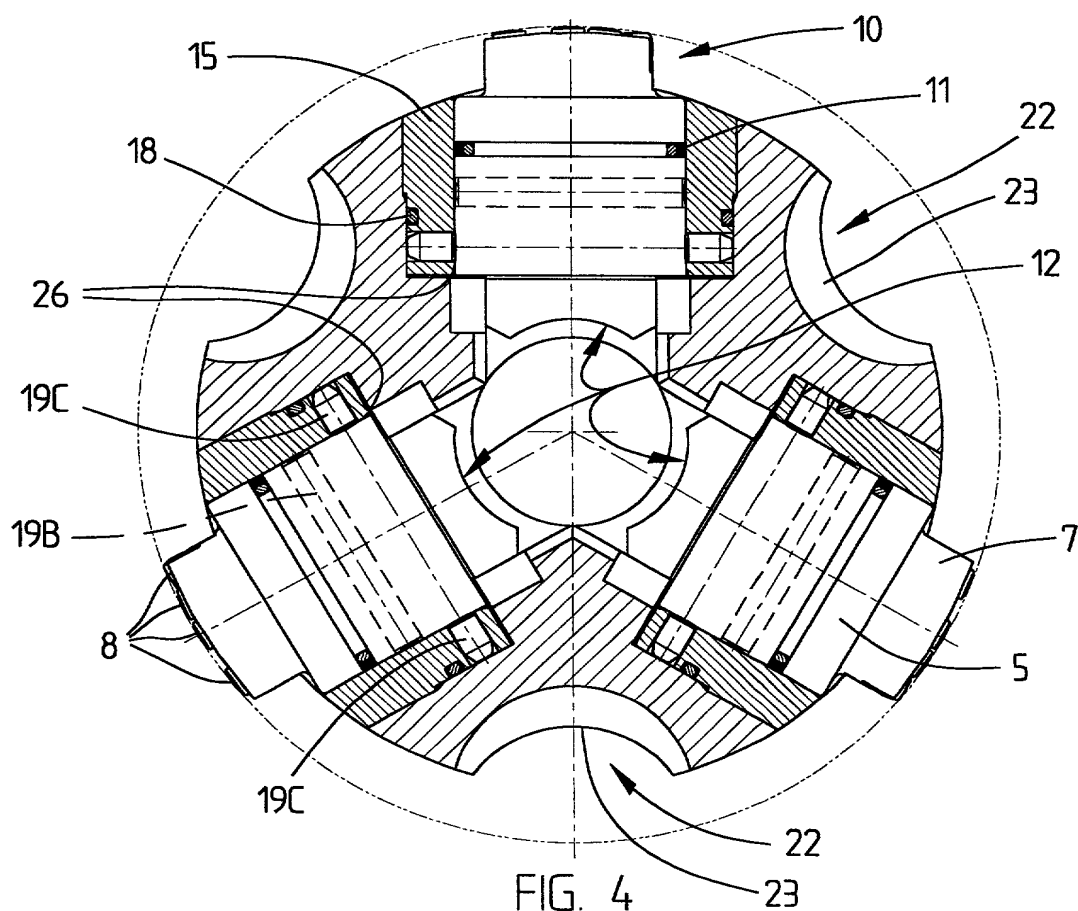


FIG. 4

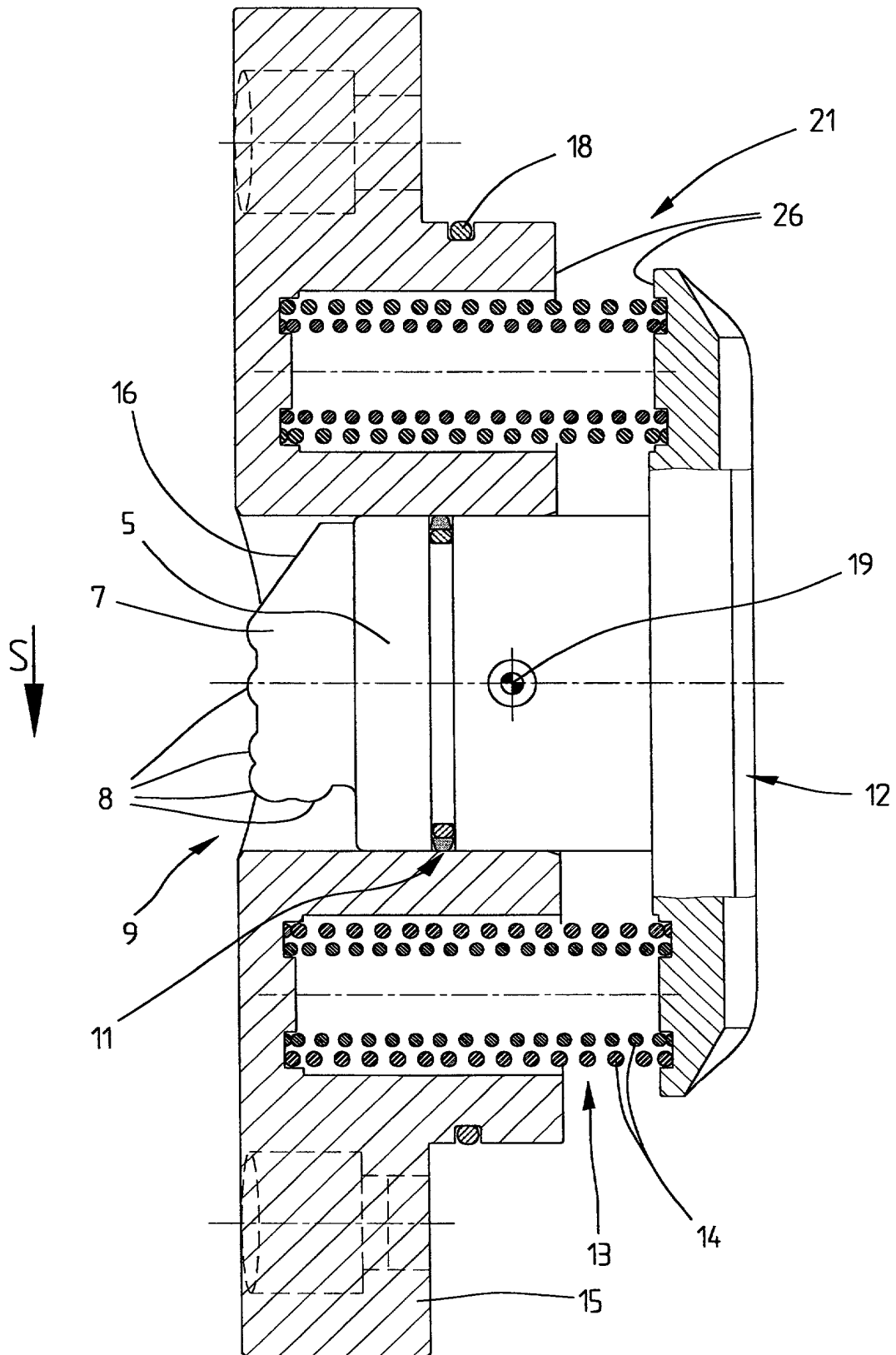


FIG. 5